

Environmental weeds and granite outcrops: possible solutions in the "too hard basket"?

J P Pigott*

Western Australian Herbarium, Department of Conservation and Land Management, Kensington, WA

*Present address: Agriculture Victoria - Frankston, Keith Turnbull Research Institute, Ballarto Road Frankston, VIC
email: Patrick.Pigott@nre.vic.gov.au

Abstract

Granite outcrops and the myriad plant communities found associated with them are particularly vulnerable to weed invasion. Undesirable impacts can result from many species or just one aggressive invasive species. Suggestions for weed planning and management are made in relation to granite outcrops, but knowledge gaps are discussed as well.

Keywords: environmental weeds, biotic threat, threatened flora, granite outcrops

Introduction

Weeds are a major threat to the conservation of biodiversity in Australia, at species and ecosystem levels (Adair 1995). Known impacts for ecosystem function include competition for resources, prevention of recruitment, and altered fire regimes (Csurhes & Edwards 1998). Weed invasions are known to alter vegetation structure (Bridgewater & Backshall 1981) and have been implicated in the extinction of threatened species (Leigh & Briggs 1992).

Granite outcrops have unique features such as 'rock meadows' and crevices, which have high levels of floristic richness and endemism (Hopper *et al.*, 1997). Soils in these environments as well as around the base of outcrops often have seasonally high moisture levels. Combined with possible exposure to fertilizer drift and disturbance from fire or recreational activities, these habitats are likely to be highly vulnerable to opportunistic invasions from introduced plant propagules (Pigott & Sage 1997).

Studies of flora on granite outcrops in south-west WA have reported high numbers of exotic species (Hopper *et al.* 1997; Hussey 1993). Another granite outcrop study found a lower than expected proportion of weeds but the negative impacts of a few serious species (Pigott & Sage 1997). Increased proportions of weeds in relation to native species as well as evidence of aggressive species are alarming as both situations ultimately lead to breakdown of plant communities.

Types of weeds

Some 54 exotic plants (presumed naturalized) have been recorded as associated with granitic habitats and soil types in WA (Anon 1998). The true number is likely to be higher as many weed invasions remain unvouchered (Pigott 1999), existing specimen labels lack sufficient details, or the habitat association has not been databased. Weeds worth noting here include *Asparagus asparagoides*, a Weed of National Significance (Thorpe 1999), *Watsonia meriana* var *bulbillifera*, recorded in granite

outcrops at Helena Valley (Hussey 1993), *Juncus bufonius* and *Casuarina cunninghamiana* subsp *cunninghamiana*, examples of herbaceous and woody weeds with high potential invasiveness and impact. For example many of the cosmopolitan weeds collected at Yilliminning Rock in south-west WA (Pigott & Sage 1997) are not included above. Some of the weeds recorded were *Aira careophyllaceae*, *Briza maxima*, *B. ninima*, *Hypochoeris glabra*, *Romulea rosea* var *australis* and *Ursinia anthemoides*.

As in this study, weeds recorded for granite outcrops and surrounding vegetation are mostly annual species e.g. Poaceae (Hopper *et al.* 1997) or those with annual emergent cycle, such as the Iridaceae family (Hussey 1993). These plants are able to respond rapidly to changing environments through spread of wind-borne seed or underground reproductive parts. Spread of weeds by rabbits is common, introducing quite noxious species such as cape weed (*Arctotheca calendula*) to disturbed areas adjacent to healthy bushland (Hussey 1998).

Examples of weed threats

For south-western Western Australia, some 5 species of threatened flora associated with granite habitats are recorded as threatened by environmental weeds (Brown *et al.* 1998; Sage & Pigott 1999). These are *Caladenia caesarea* subsp *maritima* ms, *Darwinia acerosa* and *Villarsia calthifolia* (all declared Rare), *Caladenia integra* (Priority 4) and *Goodenia drummondii* subsp *megaphila* (Priority 3). All are threatened by annual herbaceous weeds (unpublished data). An example of a woody weed affecting biodiversity conservation in granite outcrops is known from Victoria. Boneseed (*Chrysanthemoides monilifera* spp *monilifera*), another Weed of National Significance, is threatening populations of *Pterostylis truncata* at the You Yangs Regional Park, near Melbourne, Victoria (Miller & Eales 1999).

Rapidly spreading and aggressive environmental weeds threaten other special plants, such as the granite endemic *Pimelea graniticola* (formerly a P4). In this example *Freesia alba* x *leichtlinii* is altering the structure and potentially the composition of several plant

communities at Yilliminning Rock in WA's wheatbelt (Pigott & Sage 1997).

To date there are no reports of endangered plant communities directly threatened by environmental weeds. This could largely be due to reporting and the relatively low numbers of vegetation studies on granite outcrops in the region. However for Victoria, rock outcrop vegetation (including granite) is threatened by 26 serious weeds (about 25% of local weeds) (Carr *et al.* 1992).

Weed management planning

Weed management in granite outcrops is no different to weed management in other types of remnant vegetation. Identification and mapping of priority weeds is an important first step in the overall planning process (Brown 2000). Site-specific information on native plant communities, threatened flora and other special issues is essential. A grid system can be used to plot populations of weed species and other important information (Brown 2000). These maps can then be used by whoever carries out the control work, *e.g.* community group or local government workers. Choice of control methods is important as resources in local government and community groups are limited. Monitoring is also critical, particularly where eradication of a weed is the desired result (Brown *et al.* 1999). Weed management plans should relate or be integrated with management or rehabilitation plans for a remnant.

However, it is also important to consider the source of the weed and the likely impacts of any control work. Other weeds are also likely to invade, taking advantage of disturbance activity associated with the removal of primary target weeds. For degraded granite outcrops, intensive management should include fencing off stock, fire management and direct seeding of appropriate native species. Some excellent case studies are provided by Hussey (1998), listing steps to take for particular situations.

Weed management techniques

The most difficult and controversial topic of remnant bushland management is undoubtedly weed control techniques. Is herbicide use appropriate at a particular site? If so, what products, rates and time of application will work best? These questions are intrinsically more difficult to answer than in an agricultural situation (Ainsworth 2000). In a crop or pasture the aim is to kill weeds whilst leaving a single crop species or a few pasture species relatively unaffected. By contrast in natural ecosystems the aim is to kill weeds whilst having no adverse effect on a wide range of different native species. Not only is the problem harder but herbicide use on most environmental weeds is commercially insignificant and therefore companies have no financial incentive to do the appropriate research. The most successful herbicides in use are those that selectively affect grasses, rather than those with a broad spectrum.

Pulling individual plants of serious environmental weeds can result in successful long-term control and improve recruitment of native species (Kirkpatrick 1986).

Community groups can successfully apply techniques of pulling or killing individual weeds with a spot application of herbicide after careful planning. This practice could be applied to weed management on granite outcrops such as removal of *Freesia alba* x *leichtlinii* at Yilliminning Rock.

Conclusions

Weeds are certainly a threat to the conservation of the unique biodiversity of granite outcrop communities. As for other specialized habitats, weeds are poorly recorded and collected for granite outcrops in WA, and particularly with respect to threatened species and communities. Careful planning can assist in removal of serious weeds and also play an important role in the management of key granite outcrop reserves. Some manual and chemical techniques are already available but there is a large knowledge gap in this subject. As in all areas of Landcare today, community groups have an important role to play in the conservation and management of granite outcrops. However resources for research into the ecology and management of environmental weeds in Australia are low and do not meet higher community expectations. It may be another example where weed science is in the "too hard basket".

Acknowledgements: The author gratefully acknowledges the assistance of N Ainsworth and the encouragement of P Withers.

References

- Adair R J 1995 The threat of environmental weeds to biodiversity in Australia: a search for solutions. In: Conserving biodiversity: threats and solutions (eds R A Bradstock, T D Auld, D A Keith, R T Kingsford, D Lunney & D P Sivertsen). National Parks and Wildlife Service, Sydney NSW, 184-201.
- Ainsworth N 2000 Herbicide advice for environmental weeds. Under Control. Newsletter of Agriculture Victoria - Frankston, Keith Turnbull Research Institute 13:5-7.
- Anon 1998 FloraBase - Information on the Western Australian flora. Department of Conservation and Land Management, Perth. [<http://www.calm.wa.gov.au/science/florabase.html>]
- Bridgewater P B & Backshall J D 1981 Dynamics of some Western Australian ligneous formations with special reference to the invasion of exotic species. *Vegetatio* 46:141-144.
- Brown A, Thompson-Dans C & Marchant N G 1998 Western Australia's Threatened Flora. Department of Conservation and Land Management, Como, WA.
- Brown K 2000 Weed Mapping. Weed Info. Environmental Weeds Action Network - Home Page, Energy Design. 2000. [<http://www.omen.com.au/~ewan/info.htm>]
- Brown K, O'Byrne M, Dixon I R & Pigott J P 1999 Weed management in remnant bushland on the Swan Coastal Plain. Ecological Connections: Ecological Society of Australia Annual Conference Handbook, September 1999, Fremantle, WA. Ecological Society of Australia, Canberra.
- Carr G W, Yugovic J V & Robinson K E 1992 Environmental weed invasions in Victoria: conservation and management implications. Department of Conservation and Environment, Melbourne.
- Csurhes S & Edwards R 1998 Potential environmental weeds in Australia: candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra.
- Hopper S D, Brown A P & Marchant N G 1997 Plants of Western Australian granite outcrops. *Journal of the Royal Society of Western Australia* 80:201-208.

- Hussey B M J 1998 How to... Manage your granite outcrops. Land for Wildlife, Department of Conservation and Land Management, Como, WA.
- Hussey B M J 1993 Naturalised plants on the southern slopes of the western end of the Helena Valley, Western Australia. The Western Australian Naturalist 19:219-240.
- Kirkpatrick J B 1986 The viability of bush in cities - Ten years of change in an urban grassy woodland. Australian Journal Botany 34:691-708.
- Leigh J H & Briggs J D 1992 Threatened Australian Plants: Overview and Case Studies. Australian National Parks and Wildlife Service. Canberra.
- Miller J & Eales C 1999 Boneseed and bridal creeper control strategy, You Yangs Regional Park. Centre for Environmental Management, University of Ballarat, Bendigo.
- Pigott J P 1999 Biogeography and predictive modelling of environmental weeds in Western Australia. In: 1999 Geodiversity: Readings in Australian Geography at the close of the 20th Century (eds J A Kesby, J M Stanley and L J Olive). School of Geography and Oceanography, University College, Australian Defence Force Academy, Canberra ACT, 67-72.
- Pigott J P & Sage L W 1997 Remnant vegetation, priority flora and weed invasions at Yilliminning Rock, Narrogin, Western Australia. Journal of the Royal Society of Western Australia 80:201-208.
- Sage L W & Pigott J P 1999 Threatened species of the Genus *Goodenia* in Western Australia. Ecological Connections: Ecological Society of Australia Annual Conference Handbook, September 1999, Fremantle, WA. Ecological Society of Australia, Canberra.
- Thorp J 1999 Weeds of National Significance. Weeds Australia - National Weeds Strategy Website. [<http://www.weeds.org.au>]